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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/663,647  
Filing Date: September 17, 2003  
Appellant(s): HOUZVICKA ET AL.

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Stephen A. Soffen  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 17 February 2009 appealing from the Office  
Action mailed 31 July 2008.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of the claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

### **(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

### **(8) Evidence Relied Upon**

US 6,080,904

CHANG et al.

06-2000

S. Zhang et al., *Anion-Modified Zirconia: Effect of Metal Promotion and Hydrogen Reduction on Hydroisomerization of n-Hexadecane and Fischer-Tropsch Waxes*, 69 FUEL PROC. TECH. 59-71 (2001)

J. C. Yori et al., *Isomerization of n-Butane on Pt/SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> and Mechanical Mixtures of Pt/Al<sub>2</sub>O<sub>3</sub> + SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub>*, 153 J. CATAL. 218-223 (1995)

### **(9) Grounds of Rejection**

The following grounds of rejection are applicable to the appealed claims:

#### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang (US 6,080,904) in view of Yori (J. C. Yori et al., *Isomerization of n-Butane on Pt/SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> and Mechanical Mixtures of Pt/Al<sub>2</sub>O<sub>3</sub> + SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub>*, 153 J. CATAL. 218-223 (1995)).

5. With respect to claims 1-5, Chang discloses a process for the production of high-octane gasoline (see Chang, column 1, lines 19-27; and column 6, lines 35-39) from a hydrocarbon feed stream with C<sub>4</sub>+ hydrocarbons cuts (see Chang, column 6, lines 1-2) comprising contacting the feed under isomerization conditions with a catalyst composition consisting of zirconium oxide modified with tungsten oxyanion and hydrogenation component of a Group VIII metal (see Chang, Abstract); wherein the hydrocarbon feed may be a pure paraffin feed having between 4 and 8 carbons (for example, C<sub>7</sub> (heptane)) (see Chang, column 7, lines 1-21); wherein the isomerization conditions comprise presence of hydrogen with a hydrogen to hydrocarbon molar ratio between 0.1 to 5 (see Chang, column 7, lines 21-44), a temperature range from 150°C

to 300°C (see Chang, column 7, lines 21-44), a total pressure of between 1 and 40 bar (see Chang, column 7, lines 21-44), and a liquid space velocity of between 0.1 to 30 h<sup>-1</sup> (see Chang, column 7, lines 21-44); wherein the catalyst composition may comprise 10-50 wt% tungsten oxide (see Chang, Example 2), with a remaining amount comprising zirconia and Group VIII metal (see Chang, Example 2); and wherein the Group VIII metal is platinum and/or palladium in an amount of between 0.01 wt% to 5 wt% (see Chang, Example 2).

Chang does not explicitly disclose wherein the catalyst consists of a mixture of aluminum and zirconium oxides modified with tungsten oxyanion.

However, Yori discloses a platinum-based zirconium oxide catalyst for use in the hydroisomerization of n-butane to produce higher octane species (see Yori, page 218). Yori explains that when a platinum-based aluminum oxide catalyst is mechanically mixed together with the platinum-based zirconium oxide catalyst to form a composite catalyst composition consisting of both aluminum and zirconium oxides, the result is a catalyst composition having increased stability and sustained catalyst activation (see Yori, page 222).

Therefore, the person having ordinary skill in the art of processes for the production of high-octane gasolines would have been motivated to incorporate use of aluminum oxides in the platinum-based zirconium oxide catalyst of Chang (as taught by Yori) in order to achieve a catalyst composition having increased stability and sustained catalyst activation.

Finally, the person having ordinary skill in the art of processes for the production of high-octane gasolines would have had a reasonable expectation of success in incorporating use of aluminum oxides in the catalyst composition of Chang because: (1) both Chang and Yori are directed to processes for the hydroisomerization of  $C_4+$  hydrocarbon feeds to produce higher octane species; (2) the catalysts of both Chang and Yori are zirconium oxide based catalysts; and (3) Chang explicitly notes the possibility for introducing additional catalyst constituents such as metal oxides (e.g. the aluminum oxides of Yori) into his catalyst (see Chang, column 6, lines 20-27).

6. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang (S. Zhang et al., *Anion-Modified Zirconia: Effect of Metal Promotion and Hydrogen Reduction on Hydroisomerization of n-Hexadecane and Fischer-Tropsch Waxes*, 69 FUEL PROC. TECH. 59-71 (2001)) in view of Yori (J. C. Yori et al., *Isomerization of n-Butane on  $Pt/SO_4^{2-}$ -ZrO<sub>2</sub> and Mechanical Mixtures of  $Pt/Al_2O_3 + SO_4^{2-}$ -ZrO<sub>2</sub>*, 153 J. CATAL. 218-223 (1995)).

7. With respect to claims 1-5, Zhang discloses a process for the hydroisomerization of a hydrocarbon feed stream with  $C_4+$  hydrocarbons cuts (see Zhang, Abstract) comprising contacting the feed under isomerization conditions with a catalyst composition consisting of zirconium oxide modified with tungsten oxyanion and hydrogenation component of a Group VIII metal (see Zhang, Abstract); wherein the hydrocarbon feed may n-hexadecane (see Zhang, Abstract); wherein the isomerization conditions comprise presence of hydrogen with a hydrogen to hydrocarbon molar ratio between 0.1 to 5 (see Zhang, Table 5), a temperature range from 150°C to 300°C (see

Zhang, Table 5), a total pressure of between 1 and 40 bar (see Zhang, Table 5), and a liquid space velocity of between 0.1 to 30 h<sup>-1</sup> (see Zhang, Table 5); wherein the catalyst composition may comprise 10-50 wt% tungsten oxide (see Zhang, Fig. 1), with a remaining amount comprising zirconia and Group VIII metal (see Zhang, Fig. 1); and wherein the Group VIII metal is platinum and/or palladium in an amount of between 0.01 wt% to 5 wt% (see Zhang, Fig. 1; and page 65).

Zhang does not explicitly disclose wherein the catalyst consists of a mixture of aluminum and zirconium oxides modified with tungsten oxyanion.

However, Yori discloses a platinum-based zirconium oxide catalyst for use in the hydroisomerization of n-butane to produce higher octane species (see Yori, page 218). Yori explains that when a platinum-based aluminum oxide catalyst is mechanically mixed together with the platinum-based zirconium oxide catalyst to form a composite catalyst composition consisting of both aluminum and zirconium oxides, the result is a catalyst composition having increased stability and sustained catalyst activation (see Yori, page 222).

Therefore, the person having ordinary skill in the art of processes for the hydroisomerization of C<sub>4+</sub> hydrocarbons would have been motivated to incorporate use of aluminum oxides in the platinum-based zirconium oxide catalyst of Zhang (as taught by Yori) in order to achieve a catalyst composition having increased stability and sustained catalyst activation.

Finally, the person having ordinary skill in the art of processes for the hydroisomerization of C<sub>4+</sub> hydrocarbons would have had a reasonable expectation of



success in incorporating use of aluminum oxides in the catalyst composition of Zhang because: (1) both Zhang and Yori are directed to processes for the hydroisomerization of C<sub>4+</sub> hydrocarbon feeds; and (2) the catalysts of both Zhang and Yori are zirconium oxide based catalysts modified with tungsten oxyanion.

#### **(10) Response to Argument**

##### **Appellant's arguments on page 4**

Appellant argues at page 4 of the brief that Chang and Zhang are silent about a catalyst composition containing aluminum.

In response to Appellant's argument, Examiner notes that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

##### **Appellant's argument on page 5**

Appellant argues at page 5 of the brief that although Yori mentions the use of platinum/alumina, the platinum/alumina is mixed with sulfated zirconia to form a sulfated catalyst which is a "completely different" catalyst from that of the claimed invention and also from the catalysts of Chang and Zhang.

In response to Appellant's argument, Examiner first notes that sulfate and tungstate are art-recognized substitute anions for use as catalyst modifying materials in hydrocarbon conversion catalysts (see e.g., Zhang, page 60) ("*The high catalytic activity of anion-modified zirconia-based catalysts such as sulfated or tungstated zirconia*

( $\text{SO}_4/\text{ZrO}_2$ ,  $\text{WO}_3/\text{ZrO}_2$ ) for hydrocarbon conversion at mild conditions is known.”). Thus, Examiner submits that the person having ordinary skill in the art would have had a reasonable expectation of success in modifying the processes of Chang and Zhang as proposed by Examiner because: (1) the sulfate of Yori’s catalyst is an *art-recognized equivalent* for the tungstate of Zhang’s and Chang’s catalyst (see MPEP §§ 2144.06, 2144.07); and (2) Zhang actually notes the possibility for improved results with a tungstate-modified zirconia catalyst in place of a sulfate-modified zirconia catalyst (see Zhang, page 65, Table 6 and accompanying text) (“*This [tungstate-modified] catalyst was much more selective for isomerization than the Pt-promoted sulfated zirconia.*”).

In addition, Examiner notes: (1) that both the “control” and “improved” catalysts of Yori are sulfated (see Yori, page 222); (2) the only substantial difference between the “control” and “improved” catalysts of Yori is the presence of alumina in the “improved” catalyst (see Yori, page 222); and (3) Yori recognizes that the results of the “improved” catalyst are attributable to the presence of alumina (see Yori, page 222) (“*It seems that the addition of  $\text{Pt}/\text{Al}_2\text{O}_3$  to  $\text{SO}_4^{2-}\text{-ZrO}_2$  enhances the conversion of  $n\text{-C}_4$  as a result of the appearance of a bifunctional reaction mechanism, which could not be obtained by supporting Pt directly over sulfated zirconia.*”) (emphasis added).

#### **Appellant’s argument on page 5**

Appellant argues at page 5 of the brief that Yori “teaches away” from a catalyst composition consisting of platinum/aluminum, because the activity and selectivity of

pure platinum/aluminum are very low, whereas the addition of sulfated zirconia gives a better stability and enhances the conversion of n-C<sub>4</sub>.

In response to Appellant's argument, Appellant is correct in saying that Yori teaches the catalytic activity and selectivity of pure Pt/Al<sub>2</sub>O<sub>3</sub> is very low (see Yori, page 222) (*"It can be seen that the catalytic activity and selectivity of pure Pt/Al<sub>2</sub>O<sub>3</sub> are very low and that the addition of Pt/Al<sub>2</sub>O<sub>3</sub> gives SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> better stability."*). However, such argument is irrelevant inasmuch as it does not address Examiner's rejection based on the combined teachings of Chang and Zhang with Yori. Thus, under the analysis as set forth in the rejection, *supra*, the alumina (aluminum oxide) of Yori would be added to the catalyst compositions of Chang and Zhang (both comprising Pt and tungstate-modified zirconia) to yield a catalyst composition such as that claimed by Appellant. From a complete reading of Yori, it is clear that the increased conversion noted by Yori is attributable to the added aluminum oxide (see Yori, page 222) (*"[T]he addition of Pt/Al<sub>2</sub>O<sub>3</sub> to SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> enhances the conversion of n-C<sub>4</sub> as a result of the appearance of a bifunctional reaction mechanism, which could not be obtained by supporting Pt directly over sulfated zirconia."*) (emphasis added).

#### **Appellant's argument on page 5**

Appellant argues at page 5 of the brief that Examiner's assertion in the Final Rejection that the addition of Pt/alumina to the SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> compound of Yori would have the same effect as if Pt/alumina were added to the catalyst of Chang is unsupported.

In response to Appellant's argument, Examiner again notes that the sulfate anion of Yori's catalyst is an *art-recognized equivalent* for the tungstate anion of Zhang's and Chang's catalyst (see e.g., Zhang, page 60) ("*The high catalytic activity of anion-modified zirconia-based catalysts such as sulfated or tungstated zirconia ( $\text{SO}_4/\text{ZrO}_2$ ,  $\text{WO}_3/\text{ZrO}_2$ ) for hydrocarbon conversion at mild conditions is known.*"). Thus, the person of ordinary skill in the art would have every reasonable expectation that the addition of Pt/alumina to the *tungstate*-modified zirconia catalysts of Chang and Zhang would perform substantially the same as that of the platinum/alumina-modified *sulfated* zirconia catalyst of Yori (see MPEP §§ 2144.06, 2144.07).

#### **Appellant's argument on page 5**

Appellant argues at page 5 of the brief that because "catalytic phenomena and chemical reactions are unpredictable" (citing *In re Mercier*, 185 USPQ 774 (CCPA 1975)), it is neither predictable nor obvious that the addition of one metal (selected from known catalytic materials) to a different catalytic material will retain similar properties when being incorporated in the other catalytic material.

In response to Appellant's argument, Examiner first notes that Appellant has not provided any substantial discussion with regard to why the Board should find *In re Mercier* persuasive or controlling with regard to the facts and the rejections at issue in the instant appeal.

Second, Examiner again notes that the sulfate anion of Yori's catalyst is an *art-recognized equivalent* for the tungstate anion of Zhang's and Chang's catalyst (see e.g.,

Zhang, page 60) ("*The high catalytic activity of anion-modified zirconia-based catalysts such as sulfated or tungstated zirconia ( $\text{SO}_4/\text{ZrO}_2$ ,  $\text{WO}_3/\text{ZrO}_2$ ) for hydrocarbon conversion at mild conditions is known.*"). Therefore, the person of ordinary skill in the art would have every reasonable expectation that the addition of Pt/alumina to the tungstate-modified zirconia catalysts of Chang and Zhang would perform substantially the same as that of the platinum/alumina-modified *sulfated* zirconia catalyst of Yori (see MPEP §§ 2144.06, 2144.07).

**Appellant's argument on page 6**

Appellant argues at page 6 of the brief that Examiner has failed to provide any reason why a person having ordinary skill in the art would have combined the prior art elements in the manner claimed.

In response to Appellant's argument, see discussion *supra* at paragraphs 5 and 7 of the rejection ("*[T]he person having ordinary skill in the art . . . would have been motivated to incorporate use of aluminum oxides in the platinum-based zirconium oxide catalyst of Chang [or Zhang] (as taught by Yori) in order to achieve a catalyst composition having increased stability and sustained catalyst activation.*") (emphasis added).

**Appellant's argument on page 6**

Appellant argues at page 6 of the brief that Yori does not disclose the addition of aluminum to a composition of zirconium oxide modified with tungsten oxyanion.

In response to Appellant's argument, Examiner notes that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

**Appellant's argument on pages 6 and 7**

Appellant argues at pages 6 and 7 of the brief that even if any increased conversion noted by Yori could be attributed to the added aluminum oxide, this increased conversion is irrelevant since the addition of alumina pertains to a sulfate compound and not to a composition of zirconium oxide modified with tungsten oxyanion.

In response to Appellant's argument, Examiner again notes that the sulfate anion of Yori's catalyst is an *art-recognized equivalent* for the tungstate anion of Zhang's and Chang's catalyst (see e.g., Zhang, page 60) ("*The high catalytic activity of anion-modified zirconia-based catalysts such as sulfated or tungstated zirconia ( $\text{SO}_4/\text{ZrO}_2$ ,  $\text{WO}_3/\text{ZrO}_2$ ) for hydrocarbon conversion at mild conditions is known.*"). Therefore, the person of ordinary skill in the art would have every reasonable expectation that the addition of Pt/alumina to the *tungstate*-modified zirconia catalysts of Chang and Zhang would perform substantially the same as that of the platinum/alumina-modified *sulfated* zirconia catalyst of Yori (see MPEP §§ 2144.06, 2144.07).

**Appellant's argument on page 7**

Appellant argues at page 7 of the brief that even if a person of ordinary skill in the art would *arguendo* have been motivated to combine Yori with either Chang or Zhang, one skilled in the art would not expect any enhanced catalytic activity by adding aluminum to the catalyst of Chang or Zhang.

In response to Appellant's argument, Examiner submits that from a complete reading of Yori, it is clear that the increased conversion noted by Yori is attributable to the added aluminum oxide (see Yori, page 222) ("*[T]he addition of Pt/Al<sub>2</sub>O<sub>3</sub> to SO<sub>4</sub><sup>2-</sup>-ZrO<sub>2</sub> enhances the conversion of n-C<sub>4</sub> as a result of the appearance of a bifunctional reaction mechanism, which could not be obtained by supporting Pt directly over sulfated zirconia." (emphasis added). Moreover, inasmuch as the sulfate anion of Yori's catalyst is an *art-recognized equivalent* for the tungstate anion of Zhang's and Chang's catalyst (see discussion *supra* at pages 8, 9, and 11-13), then the person skilled in the art would have every reasonable expectation that the addition of Pt/alumina to the *tungstate*-modified zirconia catalysts of Chang and Zhang would perform substantially the same as that of the platinum/alumina-modified *sulfated* zirconia catalyst of Yori (see MPEP §§ 2144.06, 2144.07).*

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Randy P. Boyer

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